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PREPARATION OF PLATINUM-FREE SILVER HALIDE ELECTRODES

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ABSTRACT. A method has been developed for fabricating silver halide electrodes with a nonmetallic body and the operation of these electrodes has been verified experimentally.

Silver halide electrodes are frequently used in the practice of modern /168* electrochemical measurements. As a rule they are made of platinum, sealed into glass with a subsequent electrochemical deposition of silver and anode processing in a corresponding halide solution. There are also other methods of depositing a layer of silver halide on platinum but the electrodes fabricated in the above manner are considered to be better. However, the application of platinum makes them expensive and the glass blowing operations make it difficult to obtain electrodes which have an exact specified shape.

The proposed method makes it possible to fabricate electrodes without using platinum, does not require glass blowing work, produces more durable electrodes and may be carried out easily in any laboratory.

The fabrication of the electrode (see figure). The body of the electrode 1 is machined from plexiglass (polymethyl methacrylate) and contains a drilled hole. A copper condutor 2 is introduced into the hole with a short length (2-3 mm) of silver wire soldered to its end. The point at which the silver tip protrudes from the electrode body is sealed with plexiglass dissolved in dichloroethane and carefully polished. After this the electrode body is rubbed several times with cotton wetted in a strong alkali solution. After this it is sprayed with distilled water and wiped with a piece of cotton wetted in a strong solution of tin dichloride. After this the electrode body is again carefully washed with distilled water and is kept in water until it is silvered.

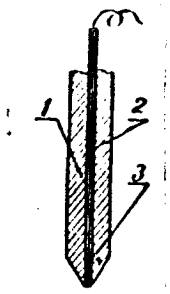

Figure. Electrode

1. electrode body
2. copper conductor
3. silver wire

*

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Solution I. Preparation of silver plating solutions. 5 grams of silver nitrate are dissolved in 200 ml of water. Approximately 70 ml of this solution are poured into a flask and ammonia is slowly added to the remaining part until the initially formed precipitate is dissolved: after this silver is added from the stock solution until the precipitate appears, etc., and until the entire supply of silver is consumed and the liquid exhibits a weak opalescence. After this the solution is filtered and water is added to make 500 ml.

Solution II. One gram of silver nitrate and 0.83 grams of Rochelle salt are dissolved in a small quantity of water in two test tubes. The silver nitrate solution is slowly added to 500 ml of boiling distilled water. When the resulting solution begins to boil again the Rochelle salt solution is added. The resulting solution is filtered after 1-2 minutes and cooled.

Silver plating. Equal volumes of Solutions I and II are poured into a test tube and rapidly shaken. The body of the electrode is submerged into the test tube for 5-6 minutes and then carefully removed without touching the walls of the test tube. This procedure is repeated 2 or 3 times after which the electrode is dried for a period of 30-40 minutes at a temperature of 40°-50°C. The thin layer of silver obtained in this manner is plated with a more durable layer of silver by using an electrolytic bath of the following composition in gm/liter; AgCl-30; KCN-50; K_2CO_3-35. Electroplating is carried on for a period of approximately 24 hours with a current of 2 mA/cm^2. It is necessary to submerge the electrode into the bath while the current is flowing.

After electroplating the electrode is carefully washed in water and then subjected to anode treatment for 30-40 minutes at a current of 3-4 mA/cm^2 in a 0.5N solution of potassium halide.

The electrodes prepared in this manner are interchangeable. /169

To make a comparative evaluation of their operation we determined the chloride ions in standard solutions with a concentration from 0 to 0.2 mg/liter. The standard solutions were prepared using 0.005N sulphuric acid.

The data presented in the table indicate that the results obtained by using electrodes prepared in the above manner do not differ in any way from results obtained with electrodes fabricated by sealing platinum wire in glass.

TABLE. AN EXAMPLE OF DETERMINING THE CHLORIDE IONS IN WATER (MEASUREMENTS WERE CARRIED OUT BY MEANS OF PPTV-1).

The test amount of Cl^-, mg/l	Established amount of Cl^-, mg/l	
	plastic electrode	platinum electrode
0.010	0.011	0.009
0.030	0.032	0.029
0.050	0.047	0.050
0.100	0.096	0.106
0.150	0.145	0.151
0.200	0.193	0.207

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